

SECTION 64

MACHINERY SPACE VENTILATION

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64.1 REFERENCES

- (64A) AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS
 – *Industrial Ventilation* (latest revision)

64.2 INTRODUCTION

This Section contains the Contractor Design and Provide general requirements for Machinery Space Ventilation. See Section 12 of the Technical Specification for the (Engineer Operating Station) EOS/Workshop areas ventilation.

For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.

64.3 GENERAL

Engine Room No. 1 and Engine Room No. 2 shall be ventilated by separate mechanical supply and mechanical exhaust systems. The supply systems shall be designed to provide combustion air to the Propulsion Engines, Ship's Service Diesel Generator sets, and Oil-fired Hot Water Heater, and to remove the heat radiated by the equipment and piping in the compartments. The exhaust systems shall be designed to remove the heated air and excess combustion air.

Systems shall be complete, with fans, ductwork, balancing dampers filters, fire dampers, protection screens, silencers, diffusers, terminals, etc., to supply the ventilation needs of the machinery spaces.

Unit heaters are specified in Section 12 of the Technical Specification.

For required duct air velocities see Section 12 of the Technical Specification.

The design, equipment and installation shall conform to the applicable requirements of Section 12 of the Technical Specification.

See Section 91 of the Technical Specification for additional requirements.

64.4 DESIGN CRITERIA

The ventilation supply rate for the Engine Rooms shall be the greater of either a one and a half (1½) minute rate of change based on gross compartment volume, or the sum of airflow requirements based on the following machinery allowances:

Propulsion Diesel Engines	4.00 CFM per Rated HP
Ship's Service or Emergency Diesel Generators	5.25 CFM per Rated KW
Oil-fired Hot Water Heater	35.0 CFM per Rated GPM
Air Compressors	30.0 CFM per Rated HP
Pumps	20.0 CFM per Rated HP
Air Conditioning Compressors	19.0 CFM per Rated HP

Supply air quantities above include allowances for all items such as switchboards, controllers, etc. associated with or auxiliary to the listed equipments.

The ventilation systems shall be designed to maintain an average *maximum* temperature in each Engine Room, and the No. 3 Ship's Service Diesel Generator acoustic enclosure of 120F degrees at full power with the summer design ambient conditions given in Section 12 of the Technical Specification. Supply terminal arrangement shall insure the maximum temperature at electrical equipment locations shall not exceed 120F degrees. ISO standard power output shall be assumed on the propulsion engines and maximum loading condition of the diesel generator sets consistent with the Electrical Load Analysis, including growth margins. Other heat producing machinery and equipment likely to be operating during full power operation shall be included in the cooling calculations. Reduced ventilation rates for partial load or heating season (ex. winter operation) conditions shall be provided by low-speed fan operation.

64.5 DESCRIPTION OF SYSTEMS

Ventilation systems shall be provided for the spaces as described below:

64.5.1 Engine Rooms No. 1 and No. 2 Supply

The fresh air supply for each Engine Room shall draw outside air through Type 316L stainless steel hinged weather louver assemblies with automatic fire dampers located in the Sun Deck midship intake plenums. The ventilation intake plenums shall be fitted with air filters in sufficient numbers and design for minimum entrance loss and moisture carryover, located so as to avoid short circuiting with exhaust air or stack gas, and to provide a face velocity through the filters as specified in Section 12 of the Technical Specification. Exterior weather doors with locks shall be provided into both intake plenums for easy filter access and replacement.

Each Engine Room shall have a two-speed (Full and $\frac{2}{3}$) dual winding direct drive axial supply fan with controller, tubular silencer, and isolation mounts located in the machinery uptakes, with high velocity distribution ductwork extending from an inlet bell terminal located in the intake plenum to multiple horizontal and vertical branch ducts with balancing dampers and adjustable supply terminals located throughout the overhead of each Engine Room. The adjustable blast terminals shall be sized for approximately 2,500 to 3,000 CFM and located to distribute the most generous amounts of supply air going to aisles, working areas and adjacent the combustion and cooling air inlets of engines and generators. Air distribution shall be in proportion to the heat released but shall not discharge directly on hot machinery, nor shall it be required that air be directed at any equipment in order for it to function properly.

The systems shall be designed so as to keep a slight negative air pressure in the Engine Rooms during normal operating conditions without disrupting operation of the Oil-fired Hot Water Heater located in Engine Room No. 2.

64.5.2 Engine Rooms No. 1 and No. 2 Exhaust

Exhaust air shall be removed from the top of each Engine Room and up through the machinery uptakes by a two-speed (Full and $\frac{2}{3}$) dual winding direct drive axial exhaust fan with controller, screened inlet bell, tubular silencer, and isolation mounts arranged vertically below the diaphragm plate in each stack and discharge directly to the atmosphere through louvered openings in the funnel. A welded flat bar coaming with weather protection and a closure device shall be provided through the diaphragm plate in each stack for exhaust air discharge to the weather. The exhaust fans are intended to operate in conjunction with the supply fans for either maximum ventilation or low speed operation for partial load or heating season conditions.

64.5.3 EOS Area Inner Bottom Voids

Ventilation for inner bottom void below the EOS shall be mechanical supply, natural exhaust with weather air. Air flow shall be designed as determined by the requirements in **TABLE 12-3** of Section 12 of the Technical Specification.

64.5.4 Welding Work Station Vent Canopy Hood

A dedicated, minimum of 1,845 CFM, exhaust system shall be provided to serve a Canopy Hood over the welding work station described in this Section and Section 80 of the Technical Specification.

The fan shall have a dedicated on/off switch in the booth, and shall exhaust up and out through the curtain plating via galvanized steel medium velocity ductwork, with bolted exhaust plenum cleanouts, to a distance of approximately eight (8) feet inboard of a Type 316L stainless steel curtain plating louver assembly, at which time the duct materials shall convert to Type 316 stainless steel ducting through to the louver assembly at an overhead of the Upper Vehicle Deck curtain plate location. The louver assembly shall be designed to meet the requirements of the *Terminals; Diffusers, Grilles, and Louvers* Subsection in Section 12 of the Technical Specification. The hood fan capacity shall be adequate to remove all welding vapors from the welding work station (see Reference (64A)).

The canopy hood shall be designed, sized and configured to encompass the entire overhead of the welding work station, meet the requirements similar to Reference

1 (64A) **Fig. VS-99-03** to the greatest extent practicable, and shall provide support for
2 the weld curtains required in Section 80 of the Technical Specification.

3 **NOTE:** The “welding work station” is defined as the “foot print” area encompassed
4 by the welding platen table and a minimum of a three (3) foot wide
5 walkway/work area around the sides and back, and four (4) foot wide
6 walkway/work area at the front of the welding platen table, and from the
7 deck plating to the canopy hood.

8 Provide four (4) 120 Vac light fixtures (sized and located to provide adequate and
9 shadow less light for fabrication/welding purposes) in the hood with a dedicated
10 on/off switch in the booth. See Sections 80, 87, 90 and 92 of the Technical
11 Specification.

12 **64.6 FIRE DAMPERS**

13 Fire dampers shall be in accordance with requirements of Section 12 of the Technical
14 Specification. The dampers shall be controllable from the fire control station, EOS and the
15 Engine Room accesses, and shall also be automatic to meet fire extinguishing Authoritative
16 Agency requirements.

17 **64.7 HEATING**

18 Hot water unit heaters shall be provided in the Engine Rooms to maintain 50F degrees
19 compartment temperatures during lay-up and shipyard periods. The heaters shall be sized
20 based on the winter ambient temperatures given in Section 12 of the Technical Specification
21 with the ventilation fans assumed secured.

22 **64.8 SPARE PARTS AND INSTRUCTION MANUALS**

23 Provide a list of recommended spare parts and special tools for those items which are
24 Contractor furnished, together with parts lists and instruction manuals necessary to maintain
25 and service provided equipment and accessories in accordance with the requirements of
26 Sections 86 and 100 of the Technical Specification.

27 **64.9 TESTS, TRIALS AND INSPECTIONS**

28 The HVAC systems shall be balanced in accordance with the requirements in Section 12 of
29 the Technical Specification.

Tests and/or Trials shall be provided in accordance with this Section and Section 101 of the Technical Specification.

Inspections shall be performed as defined in this Section and Section 1 of the Technical Specification.

64.10 PHASE II TECHNICAL PROPOSAL REQUIREMENTS

The following diagram and calculations, in addition to other deliverables required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase II Technical Proposal stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Heating, Ventilation and Air Conditioning Load Calculations – Engine Rooms

B. Duct Sizing and Pressure Loss Calculations – Engine Rooms

64.11 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS

The following drawings, calculations and report, in addition to other deliverables required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase III Detail Design stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Heating, Ventilation and Air Conditioning Load Calculations – Engine Rooms

B. Duct Sizing and Pressure Loss Calculations – Engine Rooms

C. Air Balancing Report – Engine Rooms

(END OF SECTION)